



# Build a Makerspace

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## TOOLS:

- [Drill \(1\)](#)  
*[with assorted bits.](#)*
- [Level \(1\)](#)
- [Rubber Mallet \(1\)](#)
- [Wrench \(1\)](#)



## PARTS:

- [Makerspace kit \(1\)](#)  
*[from ShoreTech Manufacturing](#)*

## SUMMARY

### Introduction by Dale Dougherty, founder of MAKE

How do we give young people more opportunities to become makers and learn practical skills they can apply to their own creative projects?

The question comes up after each Maker Faire, when I see how young people are inspired by other makers. I know they leave and want to start making things. Could schools offer more opportunities for making things? Could we provide potential makers a physical space to meet — a “makerspace” that can be organized with tools and supplies, so they can work on projects?

At World Maker Faire in New York City, we saw a solution — a simple building called Shelter 2.0 ([shelter20.com](#)), designed by Robert Bridges to provide housing in areas hit by disaster. It's a digitally fabricated shelter, between a house and a tent, that can be put up (and taken

down) with simple tools in a matter of hours, even by young makers themselves.

Can we find motivated parents and local makers to create a space and develop programs for local kids, in complete DIY fashion? Imagine a barn-raising of a makerspace in a local community. Nothing could be more in the spirit of making than young makers building their own space.

Developed by Bridges with Bill Young of ShopBot, the standard modular makerspace is 10'x16' with a barrel-shaped roof covered by canvas or corrugated tin. The plans are available under a Creative Commons license, and as a Google SketchUp model, so you can modify the design and find a local ShopBot user to create the shelter yourself. Or, we can provide the standard components as a package that ships in a 4'x8' crate. (We're still exploring different options for manufacturing and shipping.) All the instructions for building a maker- space will be online, along with videos that show you how.

Now, you don't have to build this particular building. The important thing is to find a DIY way to create a makerspace that young makers can enjoy working and playing in. A space can inspire us to see making as something that takes place at school, but isn't school. It should be placed near the playground because we want our young makers to have fun and play, while making things.

We can begin a process of open collaboration to define the materials, tools, and other supplies that are needed, and to identify programs and projects that work well for young makers. We can help identify mentors locally and online who can offer safety training, teach about tool use, and provide specialized expertise.

In addition, we can develop awards for participation and achievement to recognize the accomplishments of young makers. Plus, Mini Maker Faires can be used as local fundraisers to provide support for makerspaces and also provide an opportunity for young makers to demonstrate their projects.

Our goal is to build a network of makerspaces around the country (if not the world) and connect them online through <http://makerspace.com>.

## Step 1 — Cut your pieces.

- The files are available [here](#) in these formats:
  - ShopBot part files ..the OpenSBP format...that are ready to cut. They are the same files we use when we are cutting MakerSpaces and Shelters, and we've done all the work on them.
  - PartWorks CRV files for those that want to do your own toolpathing.
  - CAD drawings in DXF format that can be used to modify the individual pieces.
  - Cutting instructions are available in a Google Doc [here](#).
- And if they are cutting with a machine that only reads G-code, we've included a VERY rudimentary convertor that will convert ONLY the commands we use in your SBP files to G-code.
- We make no guarantees that it will work for everyone...there are lots of dialects of G-code...so use it at your own risk and test the output files thoroughly before using them in production.

## Step 2 — Account for all parts and pieces.



- **Sleepers:** these pieces are both the foundation and building backbone for a MakerSpace. All these pieces have one or two red rings engraved on the surface.
- **Ribs:** The ribs are the framework for the MakerSpace, giving it its shape. The ribs are marked with red dots.
- **Fascia:** The fascia pieces tie the wall stringers together and provide an overhang at the front and back. The fascia pieces are marked with blue dots.
- **Floor Stringer:** These parts help to ensure the correct spacing for the ribs, and also support the seams in the floor panels. They have green rings to mark them.
- **Wall Stringers:** These parts have a blue ring etched in the faces of the pockets. There are 22 identical wall stringer parts that are bolted together with 1.25" bolts, flat washers, and nuts to make 11 wall stringer assemblies.

### Step 3 — Assembling the sleepers.



- The sleepers for a Makerspace act as both the foundation and building backbone.
- Find and set the sleeper pieces. You can identify them by the red rings etched on their faces. Each set consists of a left (one red ring) and right (two red rings) face, a left (one red ring) and a right (two red rings) short core piece, and a long center core piece. Each sleeper is made up of two of these sets; there will be four all together for each makerspace. You'll also need eight 3/8" x 3.5" hex bolts for each sleeper, with sixteen flat washers and eight nuts.
- Find a pair of face pieces and insert a bolt in each hole from the back, so that the bolt shank points upward. These bolts will help keep the layers lined up. Put the two face pieces together, with the wavy joint matching.
- Add a long core piece, with the end with 2 red rings matching the short core that you just put in place.



## Step 4



- Add the second short core piece. This one will have two red rings on its face.
- Find a second set of sleeper parts, just like the first, and add a second layer of core parts just like the first.
- Add the second face pieces, completing the first sleeper.
- Add flat washers and nuts and tighten with 9/16" wrenches.
- Repeat the assembly steps with the second set of sleeper parts.

## Step 5 — Leveling the sleepers.



- Once the 2 sleepers have been assembled they need to be accurately placed on the building site, leveled and supported as needed.
- Stand the 2 sleepers upright, with the notches that will eventually hold the ribs facing up. Their inside faces must be 72" apart.
- Use the 2 spacer pieces to ensure the correct spacing.
- Use a long level, both along the sleepers and across the spacer pieces, to find the highest corner.

## Step 6



- There are an assortment of square leveling pads in the crate, with 3/4" holes drilled in them for dowels to help keep them stacked up evenly.
- Starting with the higher of the 2 sleepers, stack leveling pads and place them under the sleeper to make it level with the highest point. Place the pads evenly, with 3-4 stacks of leveling pads along each sleeper as needed. When that sleeper is level to your satisfaction, make the second sleeper level with it.
- Double check the level as you work to make sure that everything stays level.



## Step 7 — Assemble the ribs' halves.



- There are 8 rib assemblies in a 13' Makerspace, and they are assembled in 2 halves, a top and a bottom. The bottom halves are installed on the sleepers, and then the top halves are added. The 2 that go on the ends are assembled with an extra threshold piece at the bottom; they will be assembled last.
- The ribs are very similar looking to the fascia pieces, with the ribs having red dots marking the parts and the fascia pieces having blue dots.
- We'll be assembling the ribs in 2 halves to make them easy to handle. Find the two L-shaped rib pieces. The shorter one will have 5 red dots in one pocket and 1 red dot in the other, and the longer one will have 5 red dots in one pocket and 4 in the other. The wider joist piece with 5 red dots on both ends will connect these together into a lower rib assembly.
- Pick a large open area to assemble the ribs.
- Bolt 6 of these halves together with 3/8" x 1.25" bolts, flat washers on both sides, and hex nuts.
- The 2 ribs that will become the end ribs have an added piece across the bottom.
- The holes in these threshold pieces line up with the inner-most holes in the joists so they will require longer bolts. You will need two 1.25" x 3/8" bolts for each of these rib assemblies and two 2" x 3/8" bolts, with flat washers on both sides and nuts.



## Step 8



- The remaining rib pieces will be assembled into the top half of the ribs. All eight of these rib assemblies are the same.
- The number of dots in the pockets to tell you how the pieces go together.
- Once you have a top rib assembly completed, fasten the joints with 1.25" x 3/8" bolts, flat washers on both sides, and 3/8" nuts.
- When you're done you will have 8 top rib halves, 6 bottom rib halves without the added threshold pieces, and 2 bottom rib halves WITH the added threshold.

## Step 9 — Install the bottom rib halves.



- The bottom rib halves are installed in the notches in the leveled sleepers.
- Make sure the stringers are leveled and properly spaced as described in steps 4 and 5. This is critical if you want your MakerSpace to go together easily.
- Insert an end rib section (with the added threshold) in the first stringer notch. Make sure the threshold is on the outside face.
- Add a middle rib half, alternating ends so that the tall upright is on the other side of the Makerspace.
- Continue installing the rest of the rib sections, leaving the other one with the added threshold piece for last.
- Install the last rib half (with a threshold) in the last stringer notch, with the threshold piece facing the outside.

**Step 10 — Assemble the wall and floor stringers.**

- The wall and floor stringers are assembled the same way and the pieces are very similar. The wall stringers have a blue ring engraved in their pockets, and the floor stringers have green rings.
- All 22 wall stringer pieces are the same, and are joined together to make 11 wall stringers.
- To assemble a wall stringer, flip one of the pieces end-for-end.
- Put the 2 halves together.
- Align the pockets.
- Bolt the stringer pieces together with 3/8" x 1.25" bolts, with a flat washer on both sides and a nut.
- The floor stringers with green rings are assembled exactly the same way, so just follow the steps above. There are 4 floor stringer pieces, which are joined together to make 2 floor stringer assemblies.



**Step 11 — Add the floor stringers.**

- The floor stringers help stabilize the ribs and also support the seams of the floor panels.
- Carefully carry one of the floor stringers into place so that it lines up with the notches in the ribs, and slide it into place. Try to keep it level as you do this so that it doesn't jam.
- When it's in place, the top of the stringer will be level with the top of the ribs.
- Repeat with the second floor stringer.

**Step 12 — Add the bottom set of wall stringers.**

- The wall stringers help keep the ribs in alignment. We'll install the bottom 2 wall stringers on each side next.
- Supporting one of the wall stringers to keep it flat, line it up with the bottom set of notches in the sides of the ribs.
- Slide it into place evenly so that one end doesn't get ahead of the other and jam.
- Repeat this process with one above it, and 2 in the matching notches on the other side.



### **Step 13 — Add the floor panels.**

- The floor panels help to keep your Makerspace square, and also provide a stable work platform for the rest of the assembly steps.
- There are 6 floor panels. There are shallow circles in one face of each panel that mark the location of drywall screws that fasten the floor panels to the ribs. Lay out the floor panels so that this side is facing up.
- We'll start with the shorter of the 2 center row floor panels.
- You can identify the center floor panels because they have a series of notches on both long edges. We'll refer to these notches as "stitches." They help to both align the edges and support the panels on the ribs.
- There are also stitches on one of the short ends where it will meet another panel. The end of the panel that matches the end ribs with the threshold piece only has one notch.
- Carefully drop this panel in place, with the stitched end toward the middle of the makerspace. Line up the tabs in the ribs with the notches in the floor panels. When they all line up the panel will drop into place.
- Repeat with the longer center panel, making sure that the shorter end with the stitches meets the panel that was just installed.

## Step 14



- The edge floor panels have one long edge with stitches and one straight edge. The stitched edge will match the edges of the installed center panels, and the straight edges will be against the sidewall edges. You'll install the edge panels so that the seams in the short edges are staggered with the center panels for added stability.
- Place one of the longer edge panels next to the row of center panels. The edge panels are mirror images of each other, so find the longer panel that lines up with the stitches in the center row that has the shallow recesses for screw holes facing up (this is confusing, I know, but it's pretty obvious when you do it).
- Add the rest of the floor panels and you'll have a stable platform to work on.

## Step 15 — Add the top rib halves.



- Adding the top half of the ribs makes your Makerspace take shape!
- With a stable platform to work on it's time to add the top halves of the ribs. They are all the same so just start at one end and work toward the other. These rib sections are not very heavy but are somewhat awkward, so it will help if you have 3 people working on this step: 2 to lift the sections in place and 1 to insert and tighten the bolts.
- Line up the first section with the end rib and bolt them together with 1.25" x 3/8" bolts, flat washers, and 3/8" nuts.
- Continue adding rib sections until they're all done.

## Step 16 — Add the inside wall panels.



- The inside wall panels, cut from 1/2" plywood, help keep the ribs spaced correctly and squarely.
- Add one more pair of wall stringers, so that you have three on each side.
- There are 4 wall panels: 2 long ones and 2 short.
- Start with one of the short wall panels. There are shallow notches in the longer sides that will mate with the rounded tabs on the ribs.
- The end with stitches matches the stitches on the longer wall panel.
- Lift this wall panel into position, with the end with the stitches toward the middle of the Makerspace. The bottom of the wall panel will drop into the gap at the edge of floor panel, and the notches at the bottom will slot onto the ribs. The rounded tabs in the ribs will match the notches in the top edge; if not, you may have to wiggle the ribs a little to get things squared up.
- Install the rest of the wall panels the same way.

## Step 17 — Add the rest of the wall stringers.



- Install the rest of the wall stringers in the same way as the previous ones.



## Step 18 — Assemble and install the fascias.



No instructions yet.

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